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STATUS REVIEW OF SWORD TOWNSENDIA (Townsendia spatulata)
AND LIMESTONE HILLS SURVEY
BROADWATER COUNTY, MONTANA

Prepared by:

Bonnie L. Heidel
Montana Natural Heritage Program
State Library Building
P.O. Box 201800
1515 E. 6th Avenue
Helena, MT 59620

Prepared for:

Butte District
Bureau of Land Management
P.O. Box 3388
Butte, MT 59702-3388

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I. SUMMARY

Survey of the Limestone Hills for Townsendia spathulata was conducted for use in management planning by the Bureau of Land Management (BLM). This species grows on the crests of the Limestone Hills ridge system in typically low densities along ca. ten miles of ridges. A small portion of its population is in habitat considered for State Land Department quarrying leases, as determined in a concurrent study. In cooperation with the Headwaters District of the Bureau of Land Management, three ridge segments were targeted for survey (Figure 1; below).

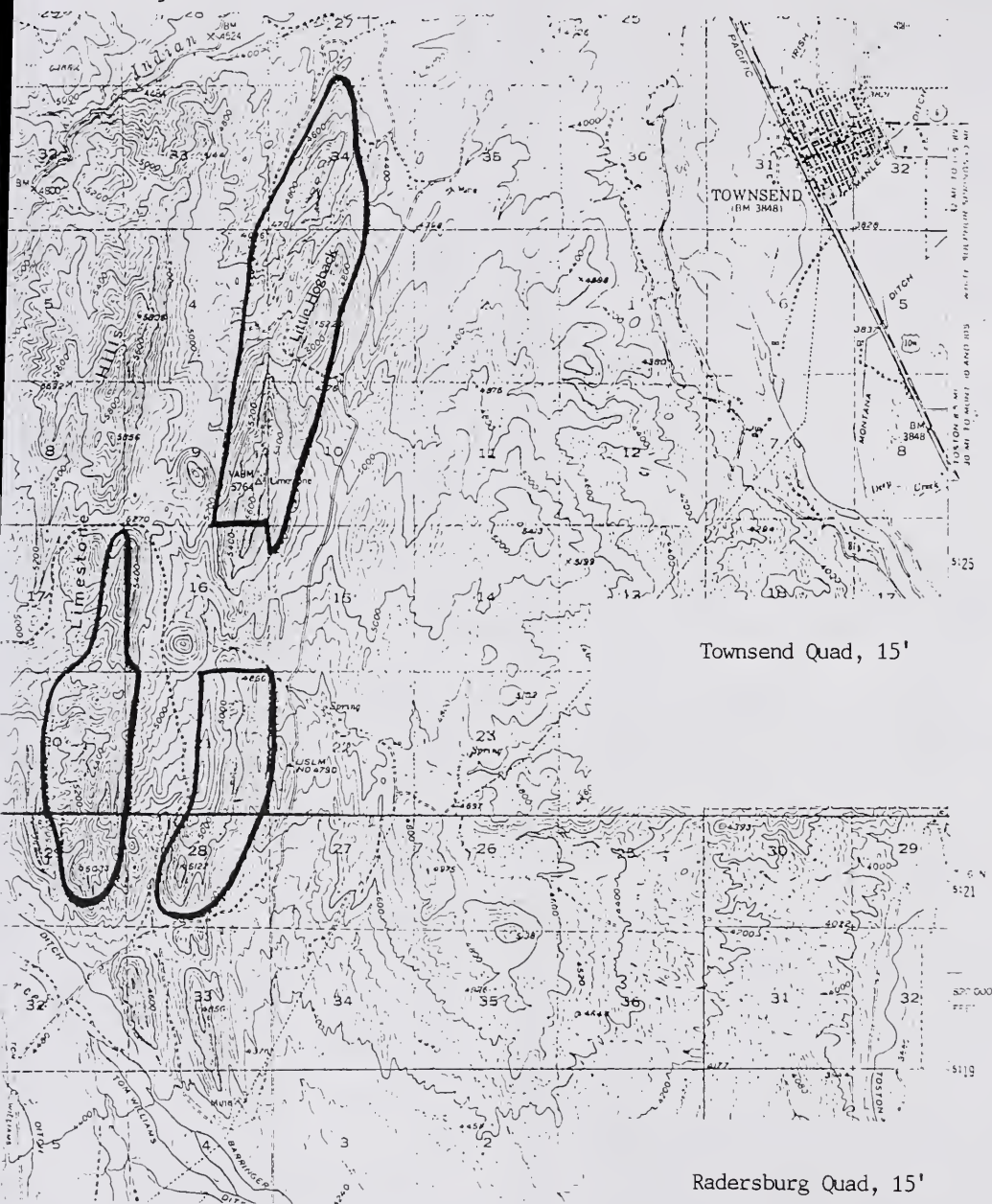
Documentation of this large, presently secure population augments previous recommendations that this species be dropped from consideration on the proposed Bureau of Land Management sensitive species list under current conditions.

The presence of Townsendia spathulata in the Limestone Hills is one of several interesting biodiversity features in the Hills with Great Basin affinity. The Limestone Hills are one of three areas in the state where this species is known, all three being on lands administered by the Bureau of Land Management.

Two other sensitive species in the vicinity were sought without success in the survey: Astragalus convallarius and Oxytropis lagopus var. conjugens (Note: O. l. var. lagopus has been collected from the project area; not O. l. var. conjugens). Other state sensitive species which occupy limestone habitat were sought but not found. In addition, a mountain plover (Charadrius montanus) was observed, and general information was collected on vegetation (reported separately to BLM).

This report represents a statewide status summary of Townsendia spathulata, with information from the Limestone Hills survey incorporated throughout.

Figure 1. Areas targeted for survey of Townsendia spathulata in the Limestone Hills. The entire area is loosely referred to as the Limestone Hills in this report, made up of two parallel north-south ridge systems, though this name is specifically used for the higher western ridge, and the interrupted eastern ridge is called Little Hogback.



II. SPECIES INFORMATION

A. CLASSIFICATION

1. **SCIENTIFIC NAME:** Townsendia spathulata Nutt.
2. **COMMON NAME:** Sword townsendia
3. **FAMILY:** Asteraceae (Sunflower Family)
4. **GENUS:** Townsendia is a North American genus, variably referred to as the daisy, Easter daisy, stemless daisy or Townsendia genus. It was named after an early collector, David Townsend, 1787-1858 of West Chester, PA.

It is coincidental that sword townsendia occurs in the Limestone Hills above the town of Townsend, which was reportedly named after the wife of a Northern Pacific Railroad president.

5. **SPECIES:** T. spathulata refers to the Greek word for broad sword, as reflected in the shape of the leaves.

This species epithet has previously been misapplied to T. condensata (Hitchcock and Cronquist 1966), which is a more widespread alpine plant of the Rocky Mountains from Alberta to central Idaho and northwest Wyoming, documented in Montana from Glacier and Park counties (Hitchcock et al. 1973) and also tracked as a state species of special concern.

B. PRESENT LEGAL OR OTHER FORMAL STATUS

1. FEDERAL STATUS

- a. **U.S. FISH AND WILDLIFE SERVICE:** Sword townsendia is placed in the "3C" category, meaning that it is no longer being considered for listing as Endangered or Threatened, having been proven to be "more abundant or widespread than was previously believed and/or not subject to any identifiable threat" as clarified in the most recent Federal Notice of Review (FR Vol. 58, No. 188).
- b. **BUREAU OF LAND MANAGEMENT:** At the time this study initiated in 1992, sword townsendia had a proposed status of sensitive (USDI Bureau of Land Management 1992), but it has since been taken off the proposed BLM state list entirely (USDI Bureau of Land Management 1993).
- c. **U.S. FOREST SERVICE:** None.
2. **STATE:** Sword townsendia has a current state rank of "S3", meaning that it may be vulnerable to threats but is not immediately imperiled. This provides basis for removing it from the state list of species of concern, except that it is a

regional endemic that still has a global rank of "G3" (globally vulnerable), and it has a history of being considered for listing under the Endangered Species Act (3C status). Its tracking status will be determined pending review of its global rank and the policy of retaining species of federal 3C status. It was previously recommended for sensitive status in Montana (Lesica and Shelly 1991).

C. DESCRIPTION

1. **GENERAL NONTECHNICAL DESCRIPTION:** *Sword townsendia* is a small herbaceous plant lying low to the ground with one (or more) inflorescence(s) mounted on the stemless crown(s) of the taproot. It typically has just one flower, but multiple flowers per plant are common. The inflorescence has the appearance of a daisy in having ray flowers ("petals"), surrounding numerous disk flowers in a flat center (Section VI. Photograph A). The ray flowers ("petals") are a subtle off-white color, and the disk flowers are yellow. The leaves are shaped like a trowel, and they are covered by long loose hairs which gives them a wooly appearance.
2. **TECHNICAL DESCRIPTION:** Cespitose acaulescent perennial (or sometimes biennial) plant less than 5 cm. high, with conspicuously woolly-villous herbage. Leaves spatulate to obovate, mostly 1-1.5 cm long and 2-4 mm. wide. Heads sessile or solitary on naked scapes less than 5 cm. long; involucre 1 cm. or more high, bracts acuminate or attenuate, rays usually 1-2 cm. long, pale off-white color.
3. **LOCAL FIELD CHARACTERS:** The ray flowers are the most prominent feature on the plant, though they have a pale off-white color that blends in with some of the surrounding outcrop setting. This small, almost camouflaged plant cannot readily be located from a distance.

It is difficult to locate individuals when they do not have open intact flowers. It cannot be dependably located except in early May through mid June (see discussion under Phenology).

Other species of *Townsendia* grow in the vicinity of *T. spathulata*, but usually in somewhat more mesic settings. These include *Townsendia hookeri* and *T. parryi*. The former differs from *T. spathulata* in having violet ray petals. The latter differs in having a distinct flowering stem as well as violet ray petals. In general, there are no other species of *Townsendia* in Montana with the combined characteristics of having broad leaves, a spatulate leaf shape, or a densely hair leaf. The appearance of *T. spathulata* is closest to that of *T. condensata*, which has a pronounced cushion-like growth form and a very different habitat in alpine settings. *Sword townsendia* is not readily confused with any other species or genus in the Sunflower Family.

D. GEOGRAPHICAL DISTRIBUTION

1. **RANGE:** Distribution of sword townsendia is restricted to Madison Group calcareous outcrops in the foothills and outliers of the Northern Rocky Mountains, as found in three Montana counties (Beaverhead, Broadwater and Carbon), and six Wyoming counties (Bighorn, Fremont, Hotsprings, Natrona, Park, and Sweetwater).

Discovery of sword townsendia in the Limestone Hills of Broadwater County, MT in 1985 by Peter Lesica represented a major northern range extension and new county record (Lesica et al. 1986).

2. CURRENT SITES:

The Montana range site data in the Biological Conservation Database (BCD) is incomplete at present because 26 of the 28 records where it has been documented in the Pryor Mountains have not been processed. In addition to Pryor Mountains records, it has a discontinuous distribution which includes the Big Horn Recreation Area, in the foothills of the Beartooth Plateau, the foothills of the Henneberry Ridge south of Bannack in southwestern Montana, and the Limestone Hills. The eight records in the BCD at present are summarized below and printed out in the Section V. at the end of this report.

PARTIAL LIST OF TOWNSENDIA SPATHULATA EORS IN MONTANA*

EO No.	County	Location
001	Carbon	Beartooth Plateau foothills; Meeteetse Spires
002	Carbon	Pryor Mts.; Bear Creek Ridge
003	Carbon	Big Horn Canyon NRA; Wasson Canyon
004	Carbon	Pryor Mts.; Red Pryor Mt.
005	Beaverhead	Sheep Corral Gulch; south of Bannack
006	Broadwater	Limestone Hills
007	Carbon	Pryor Mts.; Big Coulee
008	Carbon	Pryor Mts.; Crooked Creek

* Incomplete for Pryor Mountains

3. **HISTORICAL SITES:** None.
4. **UNVERIFIED/UNDOCUMENTED REPORTS:** None.

5. **AREAS SURVEYED BUT SPECIES NOT LOCATED:** There are many areas of Madison Group outcrop in Montana that have been surveyed for sensitive species and where sword townsendia has not been found, including Doherty Mountain, the Bannack area, the Big Belt Mountains, and others. These areas are not completely ruled out as sword townsendia habitat because it is possible that survey in these areas was conducted too late in the season to dependably locate sword townsendia.

E. HABITAT

1. **ASSOCIATED VEGETATION:** Sword townsendia occupies highly localized foothills habitat, typically occurring within a narrow zone of mountain mahogany (Cercocarpus ledifolius) stands, particularly in openings representing cushion plant grasslands or early successional stages of mountain mahogany. To a lesser extent, it occupies open grassy sparsely-vegetated limestone/dolomite outcrop at roughly the same elevation as mountain mahogany.

Mountain mahogany is a local indicator species for sword townsendia, but has a much broader ecological amplitude than sword townsendia. In the Limestone Hills, highest numbers of the latter were found in and between stunted mountain mahogany stands on gravel pavement that are taken to represent early successional stages or interstitial cushion plant grassland within mountain mahogany scrub. Associated species most consistently associated with sword townsendia include:

Agropyron spicatum
 Carex rossii
 Cercocarpus ledifolius
 Chrysopsis villosa
 Draba oligosperma
 Erigeron compositus
 Erigeron ochroleucus
 Eriogonum flavum
 Hymenoxys acaulis
 Lesquerella alpina
 Phlox hoodii

Other ridgetop species found at more than one sword townsendia subpopulation in the Limestone Hills include:

Antennaria microphylla
 Cymopterus bipinnatus
 Douglasia montana
 Haplopappus acaulis
 Juniperus scopulorum
 Lomatium cous
 Oryzopsis hymenoides
 Petrophyton caespitosum

Limestone Hills species list (cont.)

Phlox alyssifolia
 Poa secunda
 Potentilla fruticosa
 Purshia tridentata

Note: A thorough floristic list of plant species observed in the Limestone Hills has been prepared by Scow and Culwell (1993), with minor species additions made in the course of this study (annotated species list on file).

The mountain mahogany potential habitat of sword townsendia represents northern extensions of Great Basin vegetation, within a matrix of other biogeographically-interesting Great Basin vegetation. It was noted that the Artemisia nova plant community positioned along toeslopes of the Limestone Hills may represent its northernmost range extent. The biodiversity significance of this vegetation may warrant separate consideration.

In the Pryor Mountains, sword townsendia is found in mountain mahogany woodlands and cushion plant grasslands associated with Agropyron spicatum, Ceratoides lanatus, Phlox spp. and Cryptantha cana (Lesica and Achuff 1991), as well as in openings among widely-spaced Pinus flexilis and Psuedotsuga menziesii.

2. **TOPOGRAPHY:** In general, sword townsendia occupies ridge crests. Its highest numbers are on broad, flat, exposed ridge summits (Section VI. Photograph C). The ridge crests are typically part of foothills settings.

In the Limestone Hills, broad, flat expanses of ridge summit are uncommon. Most sword townsendia subpopulations are on narrow bands or along narrow ridge crests (Section VI. Photograph D).

The original Limestone Hills discovery of sword townsendia was made at a midslope position where it was very rare (Lesica et al. 1986). Two small midslope sites were relocated in the vicinity of the original collection site during this study (Section VI. Photograph E).

On the ridge top above the midslope plants were found much higher numbers and densities of the species. The ridge crests form discontinuous population cores, highly localized on any given ridge segment.

A toeslope subpopulation was also found in Sec. 10 of T.6N R. 1E (Section VI. Photograph F). Midslope and toeslope plants represent population satellites, where seeds chanced upon unvegetated substrate. These satellites are small subpopulations which are probably short-lived, as judging by the few that were found, and their low densities.

Like the Limestone Hills topographic setting, the Sheep Corral Gulch and Meeteetse Spires settings are also localized bands.

In contrast, the Pryor Mountains and Big Horn Canyon areas have areas of extensive potential habitat in dissected terrain ranging from 4000-8000 ft elevation where it occupies a range of topographic positions and has extensive potential habitat.

3. **SOIL RELATIONSHIPS:** Soils are highly calcareous, shallow and coarse, classified as arid entisols. They do not appear to have any structure or horizon differentiation, and little organic matter accumulation. They have a well-drained cobbly or sandy texture.
4. **REGIONAL CLIMATE:** Local climate conditions at sword townsendia sites are semi-arid, with low precipitation, hot summers and relatively long growing seasons.

Near the Limestone Hills in Townsend, annual precipitation is only 11 inches (U.S.D.A. Forest Service 1992). Actual precipitation levels in the Limestone Hills are reduced by the rainshadow effect of the Elkhorn Mountains. Effective precipitation for plants is further reduced by the low water retention capacity and droughtiness of soils, as well as the strong winds that increase evapotranspiration.

In Townsend, the mean winter temperature is 19.7 oF summer temperature is 66.8 oF (U.S. Department of Commerce 1982). The earliness of the growing season is perhaps a more important climatic factor than these season averages, because growth and flowering is concentrated very early in the growing season.

Near the Pryor Mountains to the north in Bridger, MT and to the southeast in Lovell, WY, mean annual precipitation is 12.7 inches and 7.1 inches, respectively (U.S. Department of Commerce 1982).

F. POPULATION DEMOGRAPHY AND BIOLOGY

1. **PHENOLOGY:** Montana collections made of Townsendia spathulata over the years have been made from 10 May to 26 June across the range of elevations at which it grows. At any given site, there is less than a one-month period of flowering and fruit maturation, which is subject to shifts depending on annual climate. The Limestone Hills survey was conducted 17-19 May at peak flowering in a somewhat early spring and unseasonably warm weather.

Flowering across the entire Limestone Hills population was closely synchronized, and estimated to span two weeks. The seeds mature and disperse within two weeks after flowering, these four weeks representing the phenological window for efficiently locating and identifying the species.

2. **POPULATION SIZE AND CONDITION:** In the Limestone Hills, the total estimated range in numbers of plants within ten miles of ridge system is between 1800-3600 individuals. The subpopulation totals are five to ten times greater on the western ridge compared to the eastern ridge. The total population size is large for this species, and the prevailing undisturbed habitat provides good condition. The occurrence has been assigned a rank of "AB" because of the uncertainties of long-term viability and defensability for what is otherwise an excellent example.

The largest populations and the largest number of populations are found in the Pryor Mountains, where it is sometimes locally common, and very widely distributed (Lesica and Achuff 1991). It is also locally common in at least part of the Big Horn Canyon National Recreation Area (Lesica pers. commun.).

3. REPRODUCTIVE BIOLOGY

- a. **TYPE OF REPRODUCTION:** Disk flowers are diecious, made up of pistils and stamens in a perfect flower. Ray flowers are strictly pistillate. Outcrossing takes place; it is not known whether the disk flowers are also capable of selfing.

There was no evidence of asexual reproduction, though apomixis cannot be ruled out.

- b. **POLLINATION BIOLOGY:** The only pollinators observed during the survey were bumblebees (Subfamily Apinae; see Section VI. Photograph A).
- c. **SEED DISPERSAL AND BIOLOGY:** The bristly pappus augments wind dispersal of seeds. The light seeds moves on wind gusts over short distances along ridges and down slope. Wind is probably also the long-distance dispersal vector, considering the exposed habitat and the strong wind currents along ridges.

Seeds mature in early summer. It is not known whether they have a dormancy or germinate in the fall. Seed "safe sites" are found on bare substrate, often between cobbles representing slightly moderated microclimate.

G. POPULATION ECOLOGY

1. BIOLOGICAL INTERACTIONS

- a. **COMPETITION:** The short stature of sword townsendia and its presumed level of dependency on early spring precipitation restrict it to sparsely vegetated settings, and make it a poor competitor. The most abundant plant species in the localized habitat where it grows are also short perennials. Grasses and shrubs making up little more than a trace of canopy cover.

- b. **HERBIVORY:** None observed. The profuse hairs reduce palatability of leaf material.

The mountain mahogany of the Limestone Hills is heavily browsed by mule deer (Scow and Culwell 1993). The browsing is heaviest in winter, when sword townsendia is dormant. Mule deer scats were common among some subpopulations to the point of altering the microhabitat (Section VI. Photograph B); but no direct affects of browsing activity were noted.

H. LAND OWNERSHIP

1. All of the known Townsendia spathulata occurrences are on lands administered by public agencies. Of the eight records in the BCD, they are split between the following management units:

BLM: Miles City District, Billings Resource Area*	3
BLM: Butte District, Headwaters Resource Area	1
BLM: Butte District, Dillon Resource Area	1
USFS: Custer Natl. Forest, Beartooth District	2
NPS: Bighorn Canyon Natl. Rec. Area	1

* This does not include all known records in the Pryor Mts.

III. ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

A. THREATS TO CURRENTLY KNOWN POPULATIONS

1. **GRAZING:** The effects of grazing are minimal for this species because it is active only early in the growing season before surrounding grasses have greened up. It occupies habitat with very low forage productivity that is typically far from any water. Its diminutive size and gravelly setting make it even unlikely to be affected by stray browsing or trampling action.

The Limestone Hills are not under grazing management. The Beaverhead County EOs are part of federal grazing allotments. The Pryor Mountains are grazed by wild horses.

2. **MINING:** It appears that the species' highest numbers in the Limestone Hills are found on some of the purest limestone, as judging by whiteness tone of the outcrop. Quarrying has eliminated species' habitat at the north end of its primary habitat on the western ridge (Section VI. Photograph G). The sword townsendia numbers within the entire proposed State Land permit areas which could be disturbed over the 50 year lease period total an estimated 390-530 plants (Scow, pers. commun.), representing ca. 10-30% of the total present population. It has been found that sword townsendia can colonize some disturbed outcrop settings (Scow and Culwell 1993), so that shifting quarrying activity would not be expected to eliminate this entire population segment.

The disposition of BLM mineral leases in the remainder of the population is unknown at this time, but current lease activity by the National Guard precludes mining.

There are also potential indirect affects of current quarrying activities, as with recent air quality emission violation charges against the quarry operator for high sulfuric and nitric acid levels, as reported recently in the local newspaper.

Quarrying activity is highly localized or nonexistent at other population sites in the Pryor Mountains and Beaverhead County at this time.

3. TIMBER HARVESTING: None.

- 4. WEED CONTROL ACTIVITIES:** Noxious weeds in the area are presently restricted to roadbeds. An infestation of spotted knapweed, leafy spurge, Dalmatian toadflax, and Canada thistle are reported on adjoining State Land in T.7N R.1E Sec. 33 W 1/2; and T.6N R.1E Sec. 4 W 1/2 (Scow and Culwell 1993).

Undesirable weeds observed along roadways on BLM lands include musk thistle, heart-podded hoary-cress and black henbane.

Since Limestone Hills access is restricted on both the State Land and BLM land (beyond Old Womans Grave Road), noxious weed introduction on vehicles should be within the realm of control, and vigilant roadside management should keep weed spread in check. Aerial herbicide spraying is unwarranted. Treatment of existing noxious weed problems does not pose a threat to sword townsendia or its habitat.

Noxious weed infestations are low or nonexistent for other sword townsendia populations in the state.

- B. MANAGEMENT PRACTICES AND RESPONSE:** The Limestone Hills area is currently leased by the Montana National Guard for training grounds. This involves earth-moving activities, arms explosions, and fire ignitions.

Earthmoving activity is restricted to areas below the ridges. There is only one roadway crossing the ridge system, at a saddle without sword townsendia habitat. All other construction lies well below sword townsendia habitat.

Projectile explosion scars are also concentrated at lower elevations and have not pocked the ridge systems. Accidental fire ignitions result from the explosions, however, and have altered ridgeslope areas of grassland vegetation. The affect of the large recent fire as observed on a burn area along the eastern ridge was to reduce plant species diversity as well as habitat structural diversity. The fire barely carried into

mountain mahogany stands, and did not affect any sword townsendia habitat. Fire is not a natural event in mountain mahogany habitats, though it may have been "natural" in downslope grasslands under phenology and frequency different from that of National Guard activity.

C. RECOMMENDATIONS FOR MAINTAINING VIABLE POPULATIONS:

There is not a perceived need for taking concerted action to maintain viable populations of sword townsendia in the Limestone Hills or at any other population site.

Should there be any signs of large-scale habitat degradation (e.g., mountain mahogany die-back) or any major alterations in land use (e.g., quarrying on BLM lands), then the species' BLM status should change to sensitive and the need reviewed for preparing a conservation strategy to maintain viable populations.

D. RECOMMENDATIONS FOR FURTHER ASSESSMENT:

The dropping of this species from proposed BLM sensitive status has already been put into effect (USDI Bureau of Land Management 1993). The present report substantiates this decision, with the qualifications noted above.

Consultation with the Wyoming Natural Diversity Database will be pursued to re-evaluate species' rangewide status. If it is potentially secure in Wyoming, then its global rank will be updated.

Further review will be given to the policy and implications of retaining species that have a "3C" status under the Endangered Species Act. If the global rank is updated and there is no value in retaining it as a 3C species, then it will be removed from the list of Montana state species of concern.

E. SUMMARY

The widespread distribution, low population densities, narrow habitat requirements and potential threats for sword townsendia (Townsendia spathulata) in the Limestone Hills were determined in survey work and incorporated in a species status review document. The Limestone Hills represent habitat for a large population having biogeographic significance at the northern end of the species' distribution.

This study was conducted concurrently with a contracted study by a private consulting firm on adjoining lands administered by State Lands Department, representing almost all of the remaining 25% of potential habitat outside BLM lands. Quarrying activity within State Lands currently affects less than 1% of the existing potential habitat. There were no immediate or perceived threats to sword townsendia

identified apart from quarrying, so that it is judged to be relatively secure in the Limestone Hills.

While sword townsendia is very rare in the Butte District of the BLM, it is known from many areas of the Pryor Mountains in the Miles City District. It has been dropped from the BLM list of proposed sensitive plants (U.S.D.I. Bureau of Land Management 1994) in keeping with its frequency, abundance, and apart lack of threats in the Pryor Mountains. This survey and status report substantiate these administrative decisions.

IV. LITERATURE CITED

- Dorn, R. D., 1984. Vascular plants of Montana. Mountain West Publishing, Cheyenne, WY.
- Fertig, 1993. Wyoming plant species of special concern. Wyoming Natural Diversity Database, Laramie. Unpubl. 19 pp.
- Heidel, B. L. and J. M. Poole. 1993. Montana plant species of special concern. Montana Natural Heritage Program, Helena. Unpubl. 21 pp.
- Hitchcock, C. L. and A. Cronquist. 1973. Flora of the Pacific Northwest. University of Washington Press, Seattle.
- Hitchcock, C. L., A. Cronquist, M. Owenby and J. W. Thompson. 1969. Vascular plant of the Pacific Northwest, Part 5. University of Washington Press, Seattle.
- Lesica, P. and P. L. Achuff. 1992. Distribution of vascular plant species of special concern and limited distribution in the Pryor Mountain Desert, Carbon County, Montana. Unpublished report for Bureau of Land Management. Montana Natural Heritage Program, Helena.
- Lesica, P., K. Lackschewitz, J. Pierce, S. Gregory and M. O'Brien. 1986. Noteworthy plant collections in Montana. Madroño 33:310-313.
- Lesica, P. and J. S. Shelly. 1991. Sensitive, threatened and endangered vascular plants of Montana. Montana Natural Heritage Program, Occasional Publ. No. 1. Helena. 88 pp.
- Scow, K. L. and L. D. Culwell. 1993. Supplementary vegetation information for Continental Lime, Inc., Indian Creek Operation, Broadwater County, Montana. Unpublished report for Bison Engineering, Inc. Western Technological and Engineering, Inc., Helena, MT.
- U.S.D.A. Forest Service 1992. Climate existing condition - Crow Creek Landscape analysis. Townsend Ranger District, Helena National Forest, Townsend, MT. 4 pp.
- U.S. Department of Commerce. 1982. Monthly normals of temperature, precipitation, and heating and cooling degree days, 1951-1980. National Oceanic and Atmospheric Administration, Climatology of the United States, No. 81. 23 pp.
- U.S.D.I. Bureau of Land Management. 1993. Draft list of sensitive and watch plant species. Billings, MT. Unpublished.
- U.S.D.I. Bureau of Land Management. 1994. Draft list of sensitive and watch plant species. Billings, MT. Unpublished.

V. ELEMENT OCCURRENCE PRINT-OUTS

Note: Maps are included for the newly documented Limestone Hills population, element occurrence number 006.

January 24, 1994

MONTANA NATURAL HERITAGE PROGRAM
Element Occurrence Record

Scientific Name: TOWNSENDIA SPATHULATA
Common Name: SWORD TOWNSENDIA

Global rank: G3 Forest Service status:
State rank: S3 Federal Status: 3C

Element occurrence code: PDAST9COM0.001
Element occurrence type:

Survey site name: MEETEETSE SPIRES
EO rank: B
EO rank comments:

County: CARBON

USGS quadrangle: TOLMAN FLAT

Township: Range: Section: TRS comments:
008S 020E 35 26 N2N2; 23 SW4

Precision: S
Survey date: 1986-06-24 Elevation: 6200 -
First observation: 1984 Slope/aspect:
Last observation: 1986-06-24 Size (acres): 50

Location:

TAKE HWY 308 FROM RED LODGE ABOUT 5 MILES TO JUST PAST STRIP MINE.
FOLLOW UNIMPROVED ROAD SOUTH OF HIGHWAY ABOUT 6 MILES TO NORTH FORK OF
GROVE CREEK.

Element occurrence data:

EST. 51-100 PLANTS, IN 4 SMALL SPARSE SUBPOPULATIONS; SEED DISPERSING;
NO EVIDENCE OF DISTURBANCE.

General site description:

LIMESTONE LITHOSOL AND TALUS; DOUGLAS FIR-LIMBER PINE FELLFIELD, WITH
ANTENNARIA, ERITRICHUM HOWARDII, SENECIO CANUS, CYMPTERUS
TEREBINTHINUS.

Land owner/manager:

BLM: MILES CITY DISTRICT, BILLINGS RESOURCE AREA
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:

ENTIRE AREA HAS NOT BEEN SEARCHED.

Information source: LESICA, PETER. DIVISION OF BIOLOGICAL SCIENCES,
UNIVERSITY OF MONTANA, MISSOULA, MT 59812.

Specimens: LESICA, P. (3403). 1986. MONTU.

January 24, 1994

MONTANA NATURAL HERITAGE PROGRAM
Element Occurrence Record

Scientific Name: TOWNSENDIA SPATHULATA

Common Name: SWORD TOWNSENDIA

Global rank: G3

Forest Service status:

State rank: S3

Federal Status: 3C

Element occurrence code: PDAST9COM0.002

Element occurrence type:

Survey site name: BEAR CREEK RIDGE

EO rank:

EO rank comments:

County: CARBON

USGS quadrangle: BIG ICE CAVE

Township: Range: Section: TRS comments:

008S

026E

24

NW4

Precision: S

Survey date: 1986-06-25

Elevation: 7380 -

First observation: 1986

Slope/aspect:

Last observation: 1986-06-25

Size (acres): 1

Location:

FROM WARREN TAKE ROAD TO GYPSUM SPRING THEN ROAD TO RED PRYOR
MOUNTAIN. FOLLOW EAST SIDE OF FIRST RIDGE SOUTHEAST OF BEAR CANYON
ABOUT 1.6 MILES SOUTHWEST TO SITE.

Element occurrence data:

SMALL POPULATION; VERY LITTLE DISTURBANCE (SMALL CATTLE TRAILS).

General site description:

STONEY OPEN SOIL ON RIM OF THE RIDGE; GRASSLANDS AND OPEN DOUGLAS
FIR-LIMBER PINE FOREST.

Land owner/manager:

CUSTER NATIONAL FOREST, BEARTOOTH RANGER DISTRICT

Comments:

SITE NOT SURVEYED COMPLETELY, OWING TO EXPANSE OF AREA.

Information source: LESICA, PETER. DIVISION OF BIOLOGICAL SCIENCES,
UNIVERSITY OF MONTANA, MISSOULA, MT 59812.

Specimens:

January 24, 1994

MONTANA NATURAL HERITAGE PROGRAM
Element Occurrence Record

Scientific Name: TOWNSENDIA SPATHULATA
Common Name: SWORD TOWNSENDIA

Global rank: G3 Forest Service status:
State rank: S3 Federal Status: 3C

Element occurrence code: PDAST9COM0.003
Element occurrence type:

Survey site name:
EO rank:
EO rank comments:

County: CARBON

USGS quadrangle: DEAD INDIAN HILL

Township: Range: Section: TRS comments:
008S 028E 24

Precision: M
Survey date: - - Elevation: 4600 -
First observation: 1983 Slope/aspect:
Last observation: 1983-05-10 Size (acres): 0

Location:
WASSIN CANYON.

Element occurrence data:
UNKNOWN.

General site description:
WEST-FACING CALCAREOUS KNOLL; CUSHION PLANT COMMUNITY.

Land owner/manager:
BIGHORN CANYON NATIONAL RECREATION AREA

Comments:
NONE.

Information source: BOTANIST, MONTANA NATURAL HERITAGE PROGRAM, 1515
EAST SIXTH AVENUE, HELENA, MT 59620-1800.

Specimens: LICHVAR (5589). 1983. NO SPECIMEN # RM.

January 24, 1994

MONTANA NATURAL HERITAGE PROGRAM
Element Occurrence Record

Scientific Name: TOWNSENDIA SPATHULATA
Common Name: SWORD TOWNSENDIA

Global rank: G3 Forest Service status:
State rank: S3 Federal Status: 3C

Element occurrence code: PDAST9COM0.004
Element occurrence type:

Survey site name: RED PRYOR MOUNTAIN
EO rank: BC
EO rank comments: SMALL POPULATION, BUT OCCURRING IN REMOTE AREA.

County: CARBON

USGS quadrangle: BIG ICE CAVE

Township: Range: Section: TRS comments:
008S 026E 13 SE4

Precision: S
Survey date: 1986-06-25 Elevation: 7880 -
First observation: 1986 Slope/aspect:
Last observation: 1986-06-25 Size (acres): 1

Location:
PRYOR MOUNTAINS, RIDGE ABOUT 1.8 AIR MILES NORTHWEST OF RED PRYOR
MOUNTAIN, ABOUT 1.0 AIR MILE WEST OF CUSTER N.F. ROAD #3091.

Element occurrence data:
SMALL POPULATION, EST. 30+ PLANTS; FRUIT AND POST-FRUITING STAGE.

General site description:
BARREN LIMESTONE RIDGE; AREA OF OPEN PSEUDOTSUGA MENZIESII/ PINUS
FLEXILIS FOREST.

Land owner/manager:
CUSTER NATIONAL FOREST, BEARTOOTH RANGER DISTRICT

Comments:
SIGHT RECORD.

Information source: SHELLY, J. S. 1986. [FIELD SURVEYS IN CARBON
COUNTY OF 23-27 JUNE.]

Specimens:

January 24, 1994

MONTANA NATURAL HERITAGE PROGRAM
Element Occurrence Record

Scientific Name: TOWNSENDIA SPATHULATA
Common Name: SWORD TOWNSENDIA

Global rank: G3 Forest Service status:
State rank: S3 Federal Status: 3C

Element occurrence code: PDAST9COM0.005
Element occurrence type:

Survey site name: SHEEP CORRAL GULCH
EO rank:
EO rank comments:

County: BEAVERHEAD

USGS quadrangle: GRANT

Township: Range: Section: TRS comments:
008S 012W 35

Precision: M
Survey date: Elevation: 6330 -
First observation: 1985 Slope/aspect:
Last observation: 1985-06-09 Size (acres): 0

Location:
JUST SOUTH OF SHEEP CORRAL GULCH, 11 KM NORTHEAST OF CLARK CANYON
RESERVOIR.

Element occurrence data:
ABOUT 50 PLANTS.

General site description:
THIN SOIL ON A LIMESTONE OUTCROP; WITH OXYTROPIS LAGOPUS, CYMOPTERUS
BIPINNATUS.

Land owner/manager:
BLM: BUTTE DISTRICT, DILLON RESOURCE AREA

Comments:
SPECIMEN VERIFIED BY A. CRONQUIST, NY.

Information source: LESICA, P., K. LACKSCHEWITZ, J. PIERCE, S. GREGORY
AND M. O'BRIEN. 1986. NOTEWORTHY COLLECTIONS:
MONTANA. MADRONO 33:310-312.

Specimens: LESICA, P. (2978). 1985. MONTU, NY.

January 24, 1994

MONTANA NATURAL HERITAGE PROGRAM
Element Occurrence Record

Scientific Name: TOWNSENDIA SPATHULATA
Common Name: SWORD TOWNSENDIA

Global rank: G3 Forest Service status:
State rank: S3 Federal Status: 3C

Element occurrence code: PDAST9C0M0.006
Element occurrence type:

Survey site name: LIMESTONE HILLS
EO rank: AB
EO rank comments:

County: BROADWATER

USGS quadrangle: TOWNSEND
PARKER
GIANT HILL

Township: Range: Section: TRS comments:
007N 001E 34 33
006N 001E 03 4; 9-10; 16-17; 20-21; 28-29

Precision: S
Survey date: 1993-05-19 Elevation: 4960 -
First observation: 1985-05-21 Slope/aspect:
Last observation: 1993-05-19 Size (acres): 500

Location:
LIMESTONE HILLS, 5 KM WEST OF TOWNSEND.

Element occurrence data:
LOCALLY RARE TO OCCASIONAL, TOTALLING 1800-3600 PLANTS,
DISCONTINUOUSLY DISTRIBUTED ALONG TWO RIDGETOPS TOTALLING ALMOST 10
MILES. MOST COMMON ON WEST RIDGE. IN PEAK FLOWER DURING THIRD WEEK OF
MAY, 1993. INCONSPICUOUS IN VEGETATIVE FORM.

General site description:
OUTCROPS ON LIMESTONE ESCARPMENT, WITH PIONEER COMMUNITIES AND
CERCOCARPUS LEDIFOLIUS SCRUB. ASSOCIATED SPECIES: HYMENOXYS ACAULIS,
PHLOX HOODII, ERIOGONUM UMBELLATUM, CAREX ROSSII, LESQUERELLA ALPINA.

Land owner/manager:
BLM: BUTTE DISTRICT, HEADWATERS RESOURCE AREA
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
STATE LAND - UNDESIGNATED

Comments:
AREA USED BY MONTANA NATIONAL GUARD FOR MILITARY PURPOSES. BEST
HABITAT FOR THIS SPECIES ALSO HAS HIGHEST LIMESTONE QUARRYING VALUE;
CONTINENTAL LIME LONG-TERM STUDY AREA IS OUTSIDE OF LARGE POPULATION
AREAS. SPECIFIC POPULATION LOCATIONS AND ESTIMATES ON FILE AT MTHP.

January 24, 1994

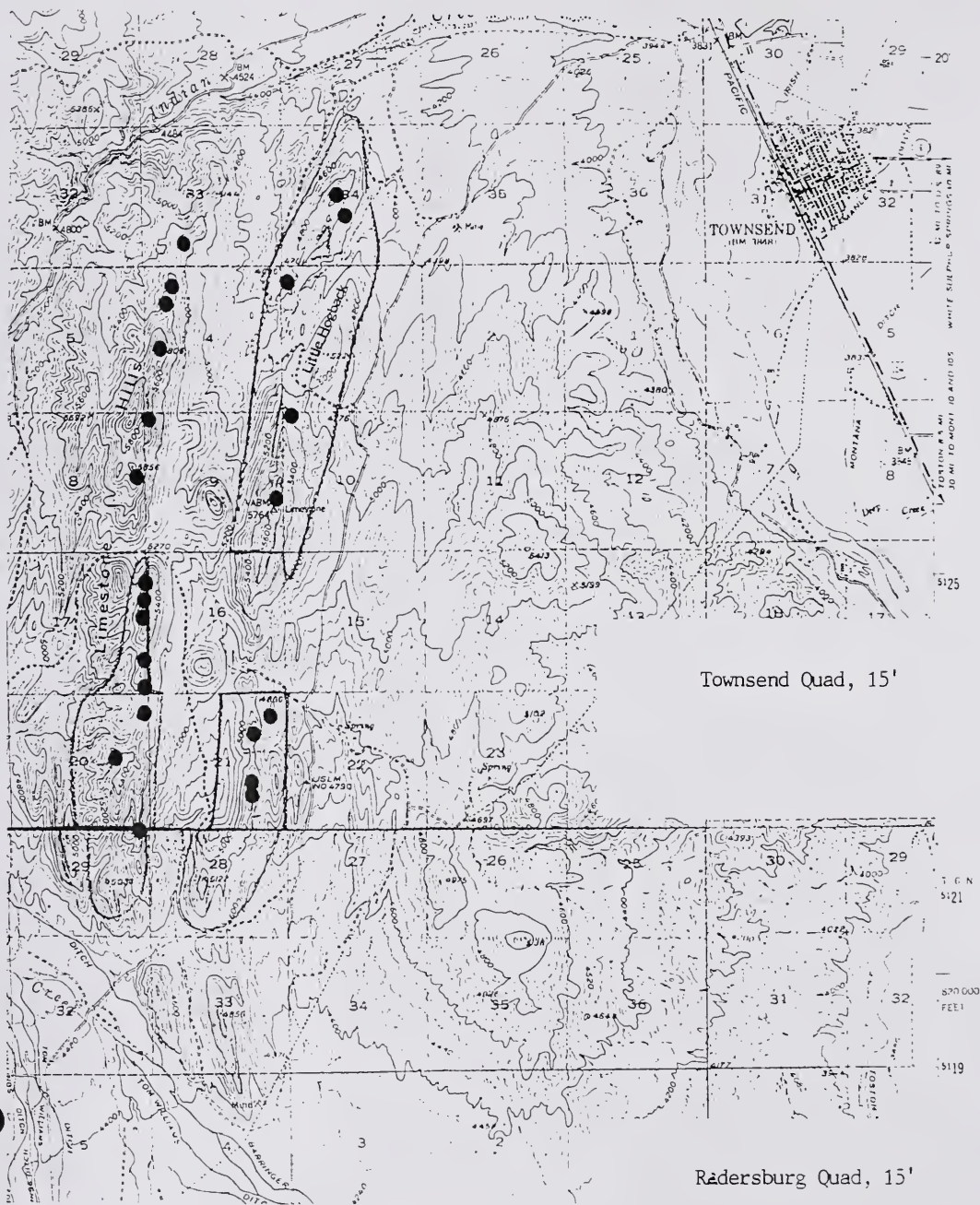
MONTANA NATURAL HERITAGE PROGRAM
Element Occurrence Record

Information source: HEIDEL, B. 1993. [MTNHP INVENTORY OF TOWNSENDIA
SPATHULATA IN THE LIMESTONE HILLS, CONDUCTED FOR
THE BUTTE DISTRICT, BUREAU OF LAND MANAGEMENT.]

Specimens: LESICA, P. (3325). 1985. MONTU, BD.
LESICA, P. (4535). 1988. SPECIMEN #109211. MONTU.
HEIDEL, B. (981). 1993. MONT.
SCOW, K. (S.N.). RM.

Map of Limestone Hills subpopulations of *Townsendia spathulata*

Note: Subpopulations within the primary study areas, encircled, were located in the course of this BLM survey. Subpopulations outside of the primary study areas were located by Westech researchers (Scow pers. commun.).



January 24, 1994

MONTANA NATURAL HERITAGE PROGRAM
Element Occurrence Record

Scientific Name: TOWNSENDIA SPATHULATA

Common Name: SWORD TOWNSENDIA

Global rank: G3 Forest Service status:
State rank: S3 Federal Status: 3C

Element occurrence code: PDAST9COM0.007

Element occurrence type:

Survey site name: BIG COULEE

EO rank: B

EO rank comments: SMALL POPULATION, BUT HABITAT REMOTE AND
UNDISTURBED.

County: CARBON

USGS quadrangle: MYSTERY CAVE

Township: Range: Section: TRS comments:
008S 023E 20 NE4SW4

Precision: S

Survey date: 1986-06-26

Elevation: 7800 -

First observation: 1986

Slope/aspect:

Last observation: 1986-06-26

Size (acres): 1

Location:

PRYOR MOUNTAINS, RIDGE ALONG WEST SIDE OF BIG COULEE, CA. 0.75-1.0 AIR
MILES SOUTH OF SALT LICK CAVE.

Element occurrence data:

UNCOMMON, CA. 20-30 PLANTS; POST-FRUITING.

General site description:

ON OPEN LIMESTONE BLUFF, IN THIN, ROCKY SOILS; AMONG PSEUDOTSUGA
MENZIESII STANDS.

Land owner/manager:

PRYOR MOUNTAIN WILD HORSE RANGE

BLM: MILES CITY DISTRICT, BILLINGS RESOURCE AREA

Comments:

SIGHT RECORD.

Information source: SHELLY, J. S. 1987. [FIELD SURVEYS IN RAVALLI
COUNTY OF 21-23 & 30-31 JULY.]

Specimens:

January 24, 1994

MONTANA NATURAL HERITAGE PROGRAM
Element Occurrence Record

Scientific Name: TOWNSENDIA SPATHULATA
Common Name: SWORD TOWNSENDIA

Global rank: G3 Forest Service status:
State rank: S3 Federal Status: 3C

Element occurrence code: PDAST9COM0.008
Element occurrence type:

Survey site name: CROOKED CREEK
EO rank:
EO rank comments:

County: CARBON

USGS quadrangle: RED PRYOR MOUNTAIN

Township: Range: Section: TRS comments:
009S 027E 14 NW4NW4

Precision: M
Survey date: Elevation: 4800 -
First observation: 1984 Slope/aspect:
Last observation: 1984-06-18 Size (acres): 0

Location:
PRYOR MOUNTAINS; ON WEST RIM OF CROOKED CREEK, CA. 10 MI. NORTH OF
COWLEY, WY.

Element occurrence data:
UNCOMMON.

General site description:
IN GRAVELLY LIMESTONE SOIL, WITH CRYPTANTHA CANA AND PHLOX HOODII.

Land owner/manager:
PRYOR MOUNTAIN WILD HORSE RANGE
BLM: MILES CITY DISTRICT, BILLINGS RESOURCE AREA

Comments:
NONE.

Information source: LESICA, PETER. DIVISION OF BIOLOGICAL SCIENCES,
UNIVERSITY OF MONTANA, MISSOULA, MT 59812.

Specimens: LESICA, P. (3032). 1984. SPECIMEN #089060. MONTU.

VI. PHOTOGRAPHS



G. Limestone quarry outside of BLM boundaries in prime Townsendia spathulata habitat, photographed from the north end of the east ridge on BLM land among Townsendia spathulata subpopulation, looking west.



E. Satellite Townsendia spathulata subpopulation habitat, on toeslope of east ridge



F. Satellite Townsendia spathulata subpopulation habitat on midslope of east ridge; original Lesica collection area



C. Optimal Townsendia spathulata habitat on Limestone Hills, found in a limited number of places along the west ridge

Note: 1) Sparse vegetation cover
 2) Short stature of mountain mahogany
 3) Loose calcareous cobble substrate



D. Most common Townsendia spathulata habitat in Limestone Hills, occurring intermittently along the length of both the east and west ridges

Note: Narrow band of unvegetated habitat in the foreground, along narrow spine of ridge



A. Townsendia spathulata close-up

Note: 1) Bumblebee (Subfamily Apinae) visiting disk flowers
 2) Distinctive spatulate leaf shape and woolly appearance



B. Townsendia spathulata habitat

Note: 1) Disk flowers in different stages of maturation
 2) Sparse ground cover with loose rock
 3) Abundant mule deer scat

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